THE VEHICLE DETECTOR CLEARINGHOUSE (VDC)
A SUMMARY REPORT

Produced by

The Vehicle Detector Clearinghouse

A multi-state, pooled-fund project managed by the Southwest Technology Development Institute (SWTDI) at New Mexico State University (NMSU), and sponsored in cooperation with the U.S. Department of Transportation FHWA

Summer 2002

Introduction

The National Vehicle Detector Clearinghouse (VDC) was established in 1996 to collect and disseminate information on vehicle detectors used for traffic monitoring, control, and surveillance applications. The VDC is a multi-state, pooled-fund project managed by the Southwest Technology Development Institute (SWTDI) at New Mexico State University (NMSU), and is sponsored in cooperation with the U.S. Department of Transportation's Federal Highway Association (FHWA). The VDC contract is administered through the Research Division of the New Mexico State Highway and Transportation Department (NMSHTD).

The VDC pooled-fund study was designated as SPR-2(181) and included the following 22 states that made financial commitments:

California	Connecticut
Florida	Georgia
Hawaii	Idaho
Illinois	Indiana
Massachusetts	Montana
Nebraska	Nevada
New Mexico	New York
North Carolina	Ohio
Oklahoma	Oregon
Pennsylvania	Tennessee
Texas	Virginia

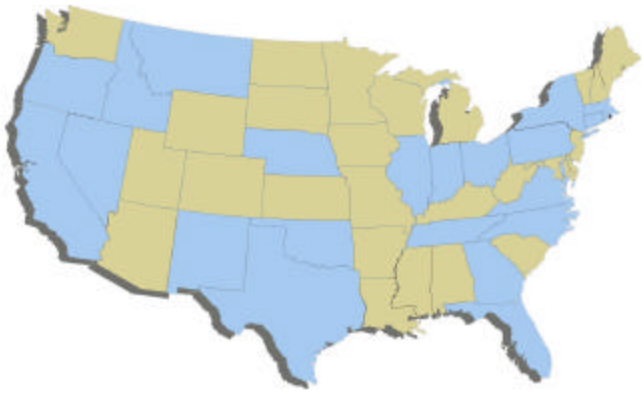


Figure 1. Twenty-two states that made financial commitments (in blue)

VDC Mission

The mission of the VDC is to provide information to transportation agencies on the capabilities of commercially available vehicle detectors by gathering, organizing, and sharing information concerning tests and test procedures in a timely, efficient, and cost-effective manner. The VDC

will also act as a catalyst for developing standard test protocols so that no matter who performed the tests, the results will become widely acceptable.

VDC Team

The VDC team is comprised of a multi-disciplinary team of professionals with experience in vehicle detectors, traffic monitoring, research, test standards, and web page development. The VDC core team is as follows:

- Luz-Elena Y. Mimbela, Project Manager, SWTDI/NMSU,
- John Hamrick, Project Consultant, Western and North Central U.S.,
- Perry Kent, Project Consultant, Eastern and Southern U.S.,
- Rudi Schoenmackers, Director, SWTDI/NMSU, and
- Gabriela Cisneros, Program Coordinator/Data Analyst, SWTDI/NMSU.

Luz-Elena Y. Mimbela, Project Manager SWTDI/NMSU, manages the VDC project overall. Ms. Mimbela has over eight years of experience in the American Society for Testing and Materials (ASTM) standard development process and serves as the Chair for ASTM's E17.52 Subcommittee on Traffic Monitoring Devices. Ms. Mimbela's educational background includes a B. S. and a M. S. in Chemical and Civil Engineering, respectively. Ms. Mimbela's engineering background is an asset to the VDC in all areas of VDC operation and specifically in the technical assistance function of the VDC. Furthermore, Ms. Mimbela's experience as a research engineer has helped her develop research skills, such as conducting literature searches, feasibility studies, state-of-the-art studies, which are valuable skills she has utilized in the varied aspects of VDC operation.

John Hamrick, VDC Project Consultant, has over 39 years experience in traffic monitoring and vehicle detection equipment. Mr. Hamrick retired from the Idaho Department of Transportation where he worked for 39 years in the Planning Division as the Traffic Survey and Analysis Manager. Mr. Hamrick was responsible for the State-Wide Traffic Monitoring and Analysis sections.

Perry M. Kent, President, Perry M. Kent and Associates, Inc, and VDC Project Consultant, has over 30 years experience in traffic monitoring and data collection. Mr. Kent retired from the FHWA where he worked for more than 27 years in the Office of Highway Information Management. His responsibilities at FHWA included the editing, processing, and analyses of classification and weight data from the States, as well as working with the State agencies with their data collection programs.

Rudi Schoenmackers, Director, SWTDI/NMSU, has been involved in the management and conduct of applied research programs and projects since 1979. Dr. Schoenmackers' responsibilities include the operation of the Southwest Region Experiment Station, a national test and data center that supports the U.S. Department of Energy's National Photovoltaic Program. Dr. Schoenmackers has many years of hands-on experience with instrumentation and laboratory and field data acquisition. He holds a Ph. D. in Nuclear Physics and was a postdoctoral fellow at the Los Alamos National Laboratory before joining NMSU. Dr. Schoenmackers extensive technical and management experience is an asset to the VDC in all areas of VDC operation.

Gabriela Cisneros, Program Coordinator-Data Analysis, SWTDI/NMSU, has recently taken on the responsibility as Webmaster of the VDC website. Ms. Cisneros has been involved in the design and management of project summary databases several programs at the Southwest Region Experiment Station. Ms. Cisneros's educational background includes a B. A. and a M.B.A in Business Administration, respectively. Ms. Cisneros has also planned, designed, and integrated text and illustrations to produce camera-ready copies of multi-lingual international training materials, reports and other publications. Ms. Cisneros' experience with database development and production of publications for varied audiences will be an asset to the VDC in the maintenance of the VDC website's numerous databases and its overall appearance and functionality.

Work plan

During the establishment period for the VDC, the statement of work included Task A – Preparation and Task B – Operation. During the preparation, numerous contacts were made with transportation officials and equipment vendors to set up a process for compiling up-to-date

information on vehicle detectors that are commercially available in the U.S. Vehicle detection included automatic detection of vehicle presence, traffic queue length, vehicle classification and speed, weigh-in-motion as well as devices which facilitate the determination of travel time, turning movements, and other measures of vehicular traffic on public roads.

Numerous copies of test reports, test protocols, product literature, and other relevant material that would help transportation officials make decisions on purchasing vehicle detection equipment were acquired during the preparation task. Lists of contacts including numbers and locations of in-use products were also compiled.

In addition, a plan for disseminating the collected information on an on-going basis to transportation professionals was formulated and included the following:

- Developing and circulating written materials such as newsletters and reports;
- Establishing and maintaining a VDC web page on the world wide web;
- Providing technical assistance utilizing appropriate means of communication including telephone, Email, VDC listserv, and regular mail; and
- Facilitating the development of standard test protocols including participation in meetings of appropriate standards development organizations.

During the VDC Operation task, the plans in the preparation phase were implemented and continuously updated and improved. During its almost 6 years of operation, the VDC has compiled invaluable information on users, vendors, applications, test protocols, of conventional as well as new vehicle detection technologies.

The purpose of this report is to provide background information on the VDC, and to provide a summary of VDC activities, accomplishments, and most importantly, a vision for the future of the VDC.

Background on VDC Project

Cost-effective and efficient transportation is the backbone of the national economy. Understanding our present system is crucial for addressing future needs. To understand our present transportation system, we need to improve and standardize the procedures and devices that are used to measure and evaluate transportation systems.

Problem / Need

Vehicle detection equipment is used in traffic monitoring, surveillance and control for detecting the presence, volume, speed, class, or weight of vehicles. While some detectors such as loops are very familiar, new technologies such as video are increasingly being used for vehicle detection. Some equipment such as weigh-in-motion is so complex that agencies are reluctant to invest in it.

State and local agencies that purchase vehicle detectors need to know that the products they purchase have been tested to their satisfaction. However, because there is no standardized way that vehicle detectors are tested, purchasers must usually conduct their own product testing, investing a great deal of time and money. Tests quickly become outdated due to changing technologies and subtle changes in each model marketed. In addition, most purchasers do not have the resources to adequately train their staff in the intricacies of installation, trouble-shooting, and operation. The time and expense for every purchaser to do their own testing is wasteful and inefficient. However, the lack of standard test protocols for vehicle detectors takes a major commitment.

Furthermore, past and current use of traffic monitoring technologies has raised several concerns about data quality. These concerns include:

- The absence of hardware standardization;
- The absence of standard specifications for procurement purposes;

- The absence of performance standards and certification procedures;
- The absence of states sharing and comparing test results without test standards;
- Data inconsistencies and incompatibilities; and
- Reliability and quality control problems associated with field equipment and instrumentation.

Before the establishment of the VDC, there was a consensus that improvements in traffic data collection, monitoring, and reporting had to be made. At that time, the Highway Performance Monitoring System and the Traffic Monitoring Guide provided guidelines for traffic data, but they did not specify standards of practice by which site-specific traffic data of known accuracy was to be obtained at the state and national level. Newer versions of these documents are available. However, the newer versions still do not specify standards of practice for collecting site-specific traffic data of known accuracy. Therefore, federal, state, and industry groups all recognized the need to cooperate more closely to assure high quality data for traffic measurement.

National Vehicle Detector Test Center (NVDTC)

To address the need for quality assurance in traffic data, the Southwest Technology Development Institute (SWTDI) at New Mexico State University (NMSU) conducted a study to determine the feasibility of establishing an independent national test center dedicated to the single mission of testing, evaluation, and certification of commercially available traffic monitoring devices. The study also evaluated the development and operation of a National Vehicle Detector Test Center (NVDTC).

The specific mission for the proposed NVDTC was (SWTDI, 1992):

1. To provide independent testing facilities and services for commercial and experimental traffic monitoring devices;
2. Conduct and coordinate national field evaluations of the devices and their applications;
3. Certify the devices according to industry and government accepted standards; and
4. Ensure that standards are continuously refined and enhanced.

To carry out the mission, the NVDTC would (SWTDI, 1992):

- Service manufacturers by providing third-party, confidential-product testing and public-certification testing. These tests would verify to an international market place that these products met or exceeded industry and government accepted standards. Standards that would be reviewed for implementation would include those of the American Society for Testing and Materials (ASTM), American Association of State Highway and Transportation Officials (AASHTO), Society of Automotive Engineers (SAE), and the Institute of Electrical and Electronics Engineers (IEEE).
- Work with manufacturers to assure that this industry obtains ISO-9000 certifications for products.
- Promote development of additional traffic monitoring device standards by interacting with national and international standards committees and organizations.
- Support the Federal Highway Administration (FHWA), state, and local highway agencies by providing third party testing, developing area-specific field-testing and by representing their specific concerns and requirements.
- Develop national laboratory and university programs to provide technical and scientific services to U.S. manufacturers.

The results of the NVDTC mission would produce the following results (SWTDI, 1992):

- Better products would become available in the marketplace leading to increased device reliability and quality in collected data.
- Standardization and competition among manufacturers would lead to lower costs while increasing quality.
- Device performance would adhere to recognized international standards.
- Uniform specifications would be produced and continually upgraded to aid FHWA and state highway agencies in the procurement of traffic monitoring devices.
- U.S. competitiveness in the national and international traffic-monitoring marketplace would increase.
- The next generation of highway engineers/technicians would be educated and trained at the center to be familiar with the increased complexities of instrumentation and data acquisition required for efficient management of our transportation system.

VDC Established

Market research from the feasibility study for a NVDTC found that both vendors and users acknowledged the need for standard testing of equipment and generally supported the concept of the NVDTC. As a result, two pooled-fund projects, one from the Travel Monitoring Division of the FHWA Office of Highway Information Management and another from the Intelligent

Vehicle Highway System (IVHS) Research Division of the FHWA Office of Safety and Traffic Operations Research and Development, were combined into pooled-fund project SPR-2(181) which was approved for the purpose of establishing the test center. Twenty-two states made financial commitments to pooled-fund project SPR-2(181) totaling over $700,000. As of 1999 twenty of the twenty-two states had sent in funds totaling $455,000, which was not enough to do field tests of all vehicle detectors, much less to finance an on-going national test center.

Therefore, the funds from pooled-fund project SPR-2(181) were used to fund the development and operation of the National Vehicle Detector Clearinghouse (VDC). The VDC was established in 1996 for the purpose of 1) providing information on vehicle detectors, tests, and points of contact and 2) promoting standard test protocols for vehicle detectors.

VDC Accomplishments

To fulfill the VDC mission of providing information to transportation agencies on the capabilities of commercially available vehicle detectors, VDC team members attend relevant conferences and collect information from users and vendors of vehicle detectors. To share the gathered information, VDC team members have established a VDC web site at http://www.nmsu.edu/~traffic, which is maintained by the Southwest Technology Development Institute at New Mexico State University (SWTDI\NMSU). The contents of the VDC web page will be described later on in this chapter. In addition to operating the VDC web site, VDC team members provide technical assistance via the VDC listserv, telephone, Email, and regular mail.

To fulfill the second part of the VDC mission to act as a catalyst for developing standard test protocols for vehicle detectors, VDC team members participate in standards development efforts of the American Society for Testing and Materials (ASTM) and the National Transportation Communications for ITS Protocol (NTCIP) standards development organizations.

Collection of Information

To serve the function of a clearinghouse of information on vehicle detectors, VDC team members collect information on users of vehicle detectors and available technologies by three main methods. The three methods are: 1) surveys, 2) conferences, and 3) Internet searches. The following sections provide specific information regarding the first two methods. The third method of conducting Internet searches is self-explanatory and thus needs no further discussion.

Surveys

Since its establishment, the VDC has utilized surveys to collect information on users of vehicle detectors and the available technologies. Typically, the surveys were developed by VDC personnel at SWTDI/NMSU and administered by VDC consultants, John Hamrick and Perry M. Kent. Mr. Hamrick and Mr. Kent had developed substantial contact lists of State department of transportation personnel. Therefore, they took on the major role of administering the surveys

that involved State department of transportation personnel. The survey sent to vendors of vehicle detection equipment, however, was developed and administered by VDC personnel at SWTDI/NMSU. The following sections describe the three surveys developed and administered by the VDC to collect information on the users and vendors of vehicle detectors, as well as information of the degree of satisfaction of users with specific vehicle detection equipment.

State Equipment Questionnaire

The "State Equipment Questionnaire" was one of the first surveys developed by the VDC and was first distributed by VDC consultants John Hamrick and Perry Kent in 1997. The purpose of this questionnaire was to survey state transportation agencies to systematically categorize vehicle detector equipment currently in use. The survey included questions about data retrieval, installation, and equipment testing procedures. The testing procedural information was initially to be used to formally develop testing protocols for vehicle detector equipment.

Once the surveys were sent out via regular mail to the appropriate State department of transportation personnel, John Hamrick surveyed the Western and North Central states and Perry Kent surveyed the Eastern and Southern states via telephone. The telephone surveys were meant to complement the paper copy sent previously and provide a forum for clarification on survey questions for both VDC consultants and the survey respondents. As of today, a total of 36 states have submitted responses to the VDC State Equipment Questionnaire.

The responses to the VDC "State Equipment Questionnaire" were compiled in a database that can be accessed via the VDC web page under the "Databases" button and is called the "Data-Collection Equipment" database. Pages 12 and 13 show the actual State Equipment Questionnaire sent to States department of transportation personnel.

VDC Vendor Survey

The initial information on specific commercially available vehicle detection technologies came from the equipment database that was compiled as part of the 1996 National Traffic Data Acquisition conference (NATDAC) registration. The 1996 NATDAC equipment database was posted on the VDC web site. In an effort to update vendor and product information on the VDC web site, VDC team members developed a vendor form to send to

the vendors whereby they could submit updated information for their products. This vendor form is what was used to develop the current VDC Vendor Survey.

The VDC Vendor Survey was sent to vendors on the existing equipment database and to additional vendors and the information received was compiled into a database called "Vehicle Detection and Surveillance Technologies." Currently, this database is available on the VDC web site by clicking on the "New VDC web site under construction" link and then clicking on the "Equipment" button. The vendor information compiled from the VDC Vendor Survey responses can also be found in the "Summary of Vehicle Detection and Surveillance Technologies Used in Intelligent Transportation Systems" document produced by the VDC in the Fall of 2000. This document will be discussed in the section titled "VDC Detector Handbook" later on in this chapter of this report. Pages 15 and 16 show the most recent survey used for sending to vendors of vehicle detection equipment.

STATE EQUIPMENT QUESTIONNAIRE

The Vehicle Detector Clearinghouse is a pooled fund project sponsored in cooperation with the U.S. Department of Transportation Federal Highway Administration.

****

Contact Name: _____

Title: _____

Address: _____

_____

_____

Telephone No.: _____

Fax No.: _____

E-mail address: _____

****

Vehicle Detector Clearinghouse

The mission of the Vehicle Detector Clearinghouse (VDC) is to provide information to transportation agencies on the capabilities of commercially-available vehicle detectors (sensors and recorders) by gathering, organizing, and sharing information concerning tests and test procedures in a timely, efficient, and cost-effective manner. The clearinghouse will be a catalyst for developing standard test protocols so that no matter who performs the tests, the results will be widely acceptable.

The VDC will compile up-to-date information on vehicle detectors that are commercially available in the U.S. The VDC will acquire copies of test reports, test protocols, product literature, and other relevant material that will help State transportation officials make decisions on purchasing vehicle detection equipment. The VDC will also compile lists of contacts for further information and summary information about the numbers and locations of in-use products, with an emphasis on information about the installation, calibration, and accuracy of vehicle detectors.

Contact:

John Hamrick (208) 342-2983 - jhamrick@micron.net -- Western & North Central U.S.
Perry Kent (843) 215-0502 or pkent1995@aol.com -- Eastern and Southern U.S.

URL address: **http://www.nmsu.edu/~traffic/**

VDC State Equipment Questionnaire

State: _____

Contact Person: _____

Data Collection Equipment Type:

1. Speed Monitoring
2. Traffic Counting (ATR)
3. Vehicle Classification
4. Weigh-in-Motion

- Effective date of information provided: _____
- Make/model of unit: _____
- Axle detectors (tubes/loops/probes/etc.): _____
- Number of sites: _____
- Number of telemetry sites: _____
- Retrieval method (site visit/modem/cell phone/radio): _____
- Power source (AC/DC/solar): _____
- Year installed: _____
- Installed by (state, vendor, or contractor name): _____

Testing: _____

- Test date: _____
- Tested by: _____
- Period tested: _____
- Test results: _____
  Please provide a summary of test results showing test procedures if available.

  Accuracy: _____

  Degree of satisfaction: _____

  Documentation: _____
- Testing issues: _____

Note: A separate sheet should be used for each type, make, and model of data collection equipment for type of data collection. Make additional copies of this form as necessary. More than one contact person may be recorded for each type of data collection. When compiling information, include planning, research, and enforcement operations.

Degree of Satisfaction Survey

To determine the degree of satisfaction of users with specific vehicle detection equipment, the "Survey of Degree of Satisfaction of State DOT Personnel with Vehicle Detection Equipment" was developed by the VDC. This survey was then administered by VDC Consultant John Hamrick to a total of 44 responses have been received to date. Initially, plans were to develop a database to compile this information. However, the development of the database was put on hold due to concerns from the VDC team of the risk of the VDC appearing to participate in "vendor bashing." However, plans to continue the development of this database will be resumed and great care will be given to insure that "vendor bashing" does not take place.

The survey sent to State departments of transportation personnel to determine their experience (e.g. degree of satisfaction, problems, etc.) with specific vehicle detection devices is shown.

MANUFACTURER AND VENDOR INFORMATION

Effective Date: _____

Manufacturer name: _____	Sales representative name(s): _____
_____	_____
	_____
Address: _____	Address: _____
_____	_____
_____	_____
Phone number: _____	Phone number: _____
Fax number: _____	Fax number: _____
e-mail address: _____	e-mail address: _____
URL address: _____	URL address: _____

PRODUCT NAME/MODEL NUMBER:

FIRMWARE VERSION/CHIP NO.:

SOFTWARE VERSION NO.:

GENERAL DESCRIPTION OF EQUIPMENT:

SENSOR TECHNOLOGY AND CONFIGURATION:

SENSOR INSTALLATION:

INSTALLATION TIME (Per Lane):

INSTALLATION REQUIREMENTS:

MAXIMUM NUMBER OF LANES MONITORED SIMULTANEOUSLY:

PRODUCT CAPABILITIES/FUNCTIONS:

RECOMMENDED APPLICATIONS:

POWER REQUIREMENTS (watts/amps):

POWER OPTIONS:

CLASSIFICATION ALGORITHMS:

TELEMETRY:

COMPUTER REQUIREMENTS:

DATA OUTPUT:

DATA OUTPUT FORMATS:

SUPPORTING DATA BASE MANAGEMENT SYSTEM:

EQUIPMENT AND INSTALLATION COSTS (One-lane and four-lane):

STATES CURRENTLY USING THIS EQUIPMENT: (Use back of this page if needed)

State	Contact name	Telephone number

SURVEY OF DEGREE OF SATISFACTION OF STATE DOT PERSONNEL WITH VEHICLE DETECTION EQUIPMENT

Review the VDC web page (http://www.nmsu.edu/~traffic/) for your state by selecting "DATABASES" button, next select "VDC Database Search" and type in the two letter abbreviation for your state (e.g. Florida - FL).

STATE:_____ Is Equipment listed on database still in use: Yes No
If no, fill out a separate survey for equipment replaced.

Answer the following for equipment currently in use:

Make: _____
Model: _____
Type:_____
No. Permanent_____ No. AC____ No. Solar ____

DATA COLLECTION: No. Modems_____ Frequency Called _____
Modem Type: _____
Rating 1-10: _____
No. Cell Phones_____ Frequency used _____
Cell Phone Brand: _____
Rating 1-10: _____
No. Site Visits_____

SENSORS: Road tube Manufacturer: _____
Rating 1-10:_____
Piezo-electric Manufacturer: _____
Piezo-electric: Lay-out per lane: _____
Rating 1-10:_____
Loops Manufacturer: _____
Loops layout per lane: _____ No. Of Turns _____
Loop MHz _____ Rating 1-10:_____
Tape Switches Manufacturer: _____
Tape switches: Layout per lane: _____
Rating 1-10:_____
Other Sensors Used (Type/Manufacturer): _____
Rating 1-10:_____

FIRMWARE (FW): Last update: _____ Version/Chip No.: _____
Rating 1-10: _____

SOFTWARE (SW): Last update: _____Version No.: _____
Rating 1-10: _____

OFFICE SOFTWARE (Office SW): Name: _____ Last update: _____Version No.: _____
Rating 1-10: _____

OVERALL EXPERIENCE WITH YOUR EQUIPMENT:

Field Equipment Problems: _____ FW, SW, Office SW Problems: _____
Problems solved by: State: _____Vendor: _____
Problems unsolved: _____
If problem solved by State, describe action taken:_____

OVERALL RATING (equipment in use) 1-10: _____

Other Comments: _____

VDC Web Page Survey

In order to provide a forum for VDC web site visitors to comment on all aspects of the VDC web page, a survey available on-line at the VDC web site was created. The survey contains the following information on the respondent: 1) name, 2) E-mail, 3) company type (e.g. government, commercial, academia, etc.), 4) company name, 5) question – What have you found to be the most useful section of the VDC web page?, 6) question – Do you have suggestions as to other sections to add to the VDC web page?, 7) question – If you are a state DOT representative, is the contact information accurate for your state?, 8) question – If no, what needs to be changed?, and 9) section where additional comments can be included. The results of this survey to date are included in the "VDC Web Page" section of this chapter.

Related Conferences

VDC team members attend transportation related events to collect information on vehicle detection equipment being used by State department of transportation personnel and others for traffic monitoring and surveillance. The most relevant of these events since the establishment of the VDC has been the North American Travel Monitoring Exhibition and Conference (NATMEC), which prior to 1998 was called The National Traffic Data Acquisition Conference (NATDAC). Since the NATDAC '96, VDC team members have actively participated in these events by attending and giving presentations and during the NATMEC '98 and NATMEC 2000 events by setting up a VDC Information booth during the exhibition. VDC team members plan to attend the NATMEC 2002 event and actively participate by giving a presentation titled "Status of the VDC" and by setting up and operating a VDC information booth.

Two other related conferences that VDC team members have attended are the Intelligent Transportation Society of America's (ITS America) Annual Meeting, and the Transportation Research Board's (TRB) Annual Meeting.

While at these events VDC team members gather information on vehicle detection technologies during the vendor expositions and field events. Furthermore, the proceedings of the NATDAC, NATMEC, Annual TRB Meeting, ITS America Annual Meeting, and WIM Conference events are part of the VDC collection of publications.

NATDAC/NATMEC

NATDAC '96 was held in Albuquerque, New Mexico on May 5-9, 1996. The conference was co-sponsored by the Federal Highway Administration (FHWA), the Alliance for Transportation Research, and the New Mexico State Highway and Transportation Department.

During the NATDAC '96 event, Mr. Ralph Gillmann of the FHWA briefly introduced the VDC during a presentation on the status of the Vehicle Detector Test Center. In addition, VDC team members Dr. Rudi Schoenmackers and Mr. John Hamrick gave a presentation titled "Testing Manual for Testing Vehicle Detector, Traffic Surveillance, and Control Devices."

NATMEC '98 was held in Charlotte, North Carolina on May 11-15, 1998 and was presented by the North Carolina Department of Transportation (DOT), Transport Canada Transports Canada, and by the FHWA. The conference was co-sponsored by the American Association of State Highway and Transportation Officials (AASHTO), Transportation Research Board (TRB), City of Charlotte DOT, Institute for Transportation Research and Education (ITRE), and North Carolina State University. During NATMEC '98, the VDC set up and operated the VDC booth where VDC brochures were handed out and the VDC web page was demonstrated.

NATMEC 2000 was held in Middleton, Wisconsin on August 27-31, 2000. The conference was sponsored by Wisconsin DOT, FHWA, TRB, AASHTO, Transport Canada Transports Canada, and by the University of Wisconsin – Madison. During NATMEC 2000, the VDC set up and operated the VDC booth and Ms. Luz-Elena Y. Mimbela, VDC Project Manager gave a presentation titled "Status of the Vehicle Detector Clearinghouse (VDC)."

Presentations

Presentations at the NATDAC/NATMEC events cover a broad range of topics related to traffic monitoring. Examples of topics of presentations given during the last three NATDAC/NATMEC events that are directly related to vehicle detection equipment are as follows:

- "Field Test of Non-Intrusive Traffic Detection Technologies" given by Amy Polk of the Minnesota DOT at NATDAC '96.

- "Houston's Real-Time Internet Traffic Reporting System" given by Dan Hickman of the Texas Transportation Institute at NATDAC '96.
- "Installation and Evaluation of Weigh-in-Motion utilizing Quartz-Piezo Sensor Technology" given by Anne-Marie McDonnell of Connecticut DOT at NATMEC '98.
- "Northeast Vehicle Classification and Weigh-in-Motion Research Findings" given by Pat Hu of Oak Ridge National Laboratory at NATMEC '98.
- "Acoustic, etc. Sensor Experience" given by David Gardner of Ohio DOT at NATMEC 2000.
- "Tests of New Classifiers: Peek's Idris and SEO's Autosense IIA" given by Neal McDonald of Illinois Toll way at NATCME 2000.

Figure 2. Speaker at NATDAC '96 during general presentation at mealtime.

Some of the general presentations are given during breakfast, while others are given during lunch. Figure 2 shows one of the speakers during mealtime at one of NATDAC'96 in Albuquerque, New Mexico. The rest of the presentations take place during concurrent sessions throughout the day. Figure 3 shows a presentation taking place during one of the concurrent sessions at NATDAC '96.

Figure 3 Concurrent Session presentation during NATDAC '96.

Field Demonstrations

The field demonstrations during past NATDAC/NATMEC events have demonstrated conventional as well as new vehicle detection equipment. The field demonstrations are a great way for people to see vehicle detection technologies in action, since the sensors are visible as well as the data collection device. Furthermore, the vendors of the technologies are available to answer general as well as specific questions during these field demonstrations. Figure 4 shows a field demonstration that took place during the NATDAC '96 event and during the NATMEC '98 event in Charlotte, North Carolina.

Figure 4. Field demonstrations during NATMEC'98 in Charlotte, North Carolina (picture on left) and NATDAC '96 in Albuquerque, New Mexico (picture on right)

Exhibitions

The exhibitions during past NATDAC/NATMEC events have included vendor displays (see Figure 5) of many types of vehicle detection equipment, service agencies that cater to the traffic monitoring community, as well as research agency displays of related traffic monitoring projects, literature, etc.

Figure 5. Vendor Exhibit during NATDAC '96 in Albuquerque, New Mexico.

As stated previously, the VDC set up and operated a display booth during the NATMEC '98 and NATMEC 2000 events. In the past, the VDC display booth contained information about VDC activities including VDC brochures and newsletters for visitors to take. Figure 6 shows the VDC booth display during the NATMEC '98 event. VDC Consultant, John Hamrick and VDC Project Manager, Luz-Elena Y. Mimbela are shown operating the booth. As previously mentioned, during the NATMEC '98 event, the VDC booth provided a laptop computer with the entire contents of the VDC web page for visitors to view.

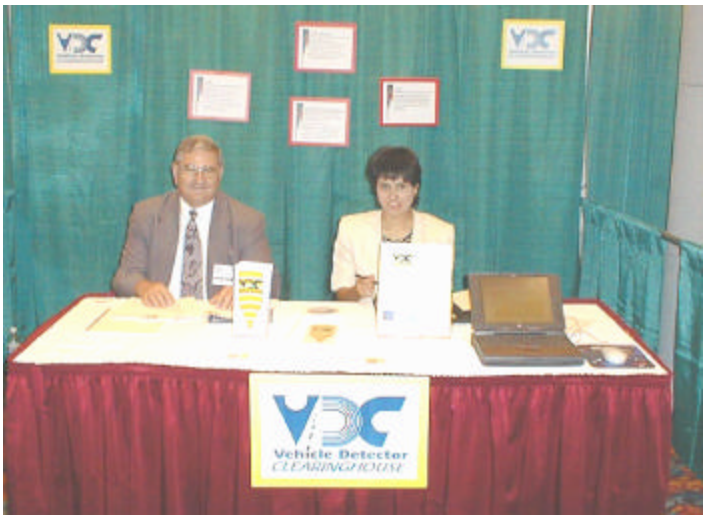


Figure 6. VDC Display Booth at NATMEC '98 in Charlotte, North Carolina.

Dissemination of Information

Dissemination of information to transportation officials and personnel is part of the VDC mission. The goal is to get the information to the transportation personnel who make decisions on vehicle detection and/or other traffic related issues.

VDC Web Page

One of the principal methods that the VDC has utilized for the dissemination of information to personnel in the traffic monitoring and surveillance fields was to establish a web site on the Internet. The Internet has proven to be a successful tool in providing a variety of information on transportation vehicle detection and surveillance topics. Information such as the types of traffic

monitoring and surveillance equipment that states are using for data collection as well as testing information can be found on one of several databases on the VDC web page, namely the state equipment database. The information for the state equipment database was compiled from responses to the State Equipment Questionnaire described previously.

Other categories included in the VDC web page include:

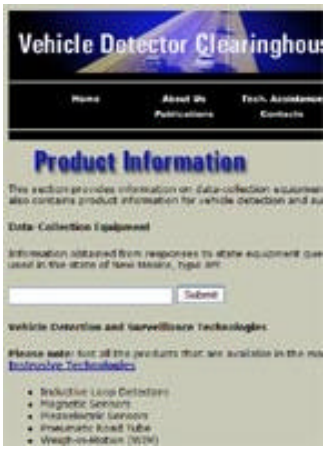
VDC Home

- Periodic updates on new information such as:
  - Meetings and conference announcements
  - Reports and papers
- VDC's mission

About Us

- Purpose of the VDC and personnel contact information.
- Presentations on the VDC

Technical Assistance



Equipment (Product Information)

- Vehicle detector equipment used by various states in the U.S searchable databases.
- Product literature of various product manufacturers.

Events

- Meetings and conference announcements, and calls for papers.

Publications

- Abstracts, conference proceedings, and reports on transportation topics.
- Newsletters and the ASTM E17.52 minutes.

Contacts

- State traffic monitoring
- Research and planning
- Technology transfer
- University transportation center

Links

- Federal and State DOTs
- International counterparts
- Product manufacturers
- Research and testing centers

- Standard development organizations
- Transportation resources

Other methods that have facilitated the dissemination of the information have been through newsletters on the VDC activities, listserv, and providing technical assistance as described below.

VDC Newsletter

In 1998 (May and September) and 1999 (April and December), the VDC published four newsletters in an attempt to disseminate information to other personnel whose responsibility is in the implementation of traffic data collection equipment in their states and do not have ready access to the internet. Previous issues of the VDC Newsletter were sent to over 300 people including state department of transportation personnel, vendors and others.

Several of the people receiving the VDC Newsletter commented on the fact that the information contained in the newsletter was not practical and thus not useful for the field person dealing with the operation and maintenance of the equipment. However, those people involved with the data collection aspect of traffic monitoring and vendors of vehicle detectors commented on the usefulness of the information contained in the VDC newsletter. As previously mentioned the original intent of the VDC Newsletter was to reach those field personnel in charge of the traffic data collection equipment and provide them ready access to VDC information available on the VDC web page. Therefore, the VDC Newsletter was a short summary of what was contained in the VDC web page.

A complete redesign of the VDC Newsletter is in progress. The new design will include information that will cater to field personnel, data collection personnel, and to others involved with vehicle detection equipment and traffic monitoring and surveillance. The next issue of the VDC Newsletter will be in late 2002.

VDC Discussion Group

A critical function of the VDC is to facilitate a communication network within the vehicle detector expert, manufacturer, and research community. The method selected for this

communication network was via the VDC Listserv (VDCLS). The listserv functions somewhat like an electronic bulletin board, but is more of a mail distribution center and a means for users to contact other users. Messages posted to the VDCLS will be sent to everyone on the list.

In the past, VDCLS subject matter has included vehicle detector equipment, product testing and evaluation, surveys, new publication notification, conference announcements, and other related information. Subscription is open to interested individuals from state, local, or federal transportation agencies, as well as vehicle detection equipment vendors and other interested parties. To subscribe, one can send an E-mail message to listproc@nmsu.edu. The message should read, "Subscribe vdcls YOUR NAME." YOUR NAME is your real name, not your E-mail name. No subject line is necessary. Another way to subscribe is on-line via the VDC web site.

Technical Assistance

Since its establishment, the VDC has provided technical assistance on traffic monitoring topics to many individuals ranging from state department of transportation personnel wanting information on Weigh-in-Motion technologies to forest rangers wishing to install vehicle detectors on National Forest parks. Technical assistance requests come via the telephone, VDC listserv, E-mail, and sometimes in person at meetings and conferences with most of them coming via E-mail. Documentation of the request and the corresponding response will be made available via the VDC web site in 2002. The posting of the technical assistance requests and responses on the VDC web page will provide yet one more tool to those dealing with transportation issues to share information regarding this topic.

VDC Detector Handbook

In the Fall of 2000 the VDC produced a document titled "A Summary of Vehicle Detection and Surveillance Technologies used in Intelligent Transportation Systems," or VDC Detector Handbook for short. The FHWA's Intelligent Transportation Systems Joint Program Office provided the funding for the development of the VDC Detector Handbook.

The VDC Detector Handbook was developed to assist in the selection of vehicle detection and surveillance technologies that support traffic management and traveler information services. The

information in the handbook is also useful to personnel involved in traffic data collection for planning, policy, and research purposes. Included in the handbook are descriptions of common types of vehicle detection and surveillance technologies in terms of theory of operation, installation methods, advantages and disadvantages, and summary information about performance in clear and inclement weather conditions and relative cost. In addition, following each technology description vendor-provided information is included about specific sensor models, their functions and applications, users, and installation and maintenance costs.

The VDC Detector Handbook is updated periodically with the latest version of the handbook available in electronic format at the VDC web page (http://www.nmsu.edu/~traffic/) under the section titled "Reports/Papers Available On-line."

Standards Development Activities

One key aspect of the VDC mission is that the clearinghouse will be a catalyst for developing standard test protocols so that no matter who performs the tests, the results will be widely acceptable. The VDC recognizes that standardized testing methods for vehicle detection devices are essential to allow end-users to obtain the highest quality products available commercially. Therefore, to fulfill this part of the VDC mission, VDC team members participate in ongoing standards development efforts. Consequently, VDC team members are active members of the American Society for Testing and Materials (ASTM) E17.52 Subcommittee on Traffic Monitoring Devices. This subcommittee is involved in the development of standards for testing vehicle detection devices and is the only one at this time addressing these standards. ASTM is one of the most prestigious standards development organizations widely recognized throughout the world and its members come from all sectors of society including government, academia, commercial, and consumers or end-users. ASTM's standards development process is consensus-based and thus is extremely rigorous. ASTM subcommittee E17.54 on Archived Data User Service (ADUS) is another standards development group that is related to vehicle detection devices or rather the data output from these devices.

Other standards development efforts related to vehicle detection equipment include the efforts by the National Transportation Communications for ITS Protocol (NTCIP) Data Collection and

Monitoring (DCM) working group. This group's focus was to develop the communication protocols dealing with the way vehicle detection devices transfer data from one device to another. VDC team members participated in the NTCIP DCM working group during the development of the list of data elements and the format of these data elements.

The remainder of this section will be devoted to the discussion of the activities of the ASTM E17.52 Subcommittee on Traffic Monitoring Devices, since as previously mentioned this is where VDC members are more actively involved.

ASTM E17.52 Subcommittee Participation

ASTM Subcommittee E17.52 on Traffic Monitoring Devices is part of the E17 main committee on Vehicle-Pavement Systems. During the December 9, 1997 meeting of E17.52, Luz-Elena Mimbela, VDC Project Manager was nominated as the new chairperson because of her previous experience with the ASTM standards development process. The challenge at that time was to increase the meeting attendance and participation of E17.52 members, especially state DOT representatives. Therefore, VDC team members decided to spread the word on the activities of E17.52 activities via the VDC web page, VDC Newsletter, VDC listserv as well as by word of mouth at related conferences. However, what seemed to work the best at increasing member participation was to simply continue submitting items for ballot since all members are required to vote on these ballots. Furthermore, in order to contest any balloted items, members must voice their opinion at the subcommittee meetings. The combined efforts by the VDC and by ASTM E17.52 subcommittee members to increase member participation were successful and currently an average of 15 members actively participate in meetings and task groups with representation from the government, academia, and commercial sectors as well as state DOT representatives from the end-user sector.

The bulk of the standards development work by ASTM E17.52 subcommittee members takes place during task group meetings. Task group meetings typically take place during ASTM E17 Committee Week, which in turn, takes place twice a year in June and in December. In addition to these meetings, task group members work on standards between meetings and communicate via telephone, E-mail and regular mail. The following sections describe the activities of some of

the task groups that E17.52 members have created to work on the development of new standards or the modification of existing standards for traffic monitoring devices. The subcommittee has concentrated on developing standards for the sensors (e.g. road tube, loops, etc.) used in traffic monitoring devices as well as on standards for the entire system (e.g. Weigh-in-Motion, etc.).

Pneumatic Road Tube

The task group created to develop standards for using and installing pneumatic tubing for roadway traffic counters and classifiers and for developing a standard specification for pneumatic tubing was Task Group E17.52.92.2 called "Pneumatic Road Tube" and was chaired by Perry M. Kent. This task group developed the "Standard Practice for Using Pneumatic Tubing for Roadway Traffic Counters and Classifiers," which was given the ASTM designation number E1957. This standard can be found in the Annual Book of ASTM Standards Volume 4.03 (ASTM, 2000 and later).

This task group also developed several drafts of the "Standard Specification for Pneumatic Tubing for Roadway Traffic Monitoring Devices," and submitted them for balloting. However, after a lot of hard work to address several "negative" votes on this standard, the subcommittee voted to abandon further attempts for balloting due to concerns about whether the standard would actually be used. Negative votes must be resolved before the standard can be accepted as a new standard. However, even after the negative votes were resolved, the consensus among members was that most users of pneumatic road tube would not go through the elaborate testing methods that would be specified in the standard due to time and budget constraints.

Review of E1442

In 1998 a task group was created to review the existing "Standard for Highway Traffic Monitoring," which was given the ASTM designation number E1442. The task group chairman was also Perry M. Kent. The review of existing ASTM standards is mandatory and takes place every 5 years by the subcommittee under which the standard was created. If the subcommittee fails to review the standard, the standard is then dropped from the books and must be balloted as a new standard if needed.

After reviewing this standard, the task group decided that the standard was no longer needed since most of the information in it was also contained in the Traffic Monitoring Guide (TMG). The subcommittee voted to let the standard expire and have it dropped from the Annual Book of ASTM Standards. Therefore, the standard with designation E1442 can only be found in copies of the Annual Book of ASTM Standards, Vol. 4.03 editions prior to 2000.

Revamp E1572

In 1997 a task group to revamp E1572, which is the "Standard Practice for Classifying Highway Vehicles from Known Axle Count and Spacing" was created with John Hamrick serving as the chairman. This standard consisted of an algorithm in the Fortran programming language and the written section explaining its use. Therefore, the task group's recommendation was to update the standard by converting the algorithm into a newer language such as C++. The C++ program for this algorithm was developed by the Idaho State Department of Transportation.

The task group decided to ballot the standard for reapproval without making changes to it to obtain feedback from members of E17.52 subcommittee as well as the entire E17 main committee on the usefulness of this standard. During the balloting process, the reapproval of this standard received a negative that was found persuasive by the subcommittee, which meant that the standard was not approved and would be dropped from Volume 4.03 of the Annual Book of ASTM Standards beginning with the 2002 edition.

Revamp of E1318

In 1998 a task group to revamp E1318, which is the "Standard Specification for Highway Weigh-in-Motion (WIM) Systems with User Requirements and Test Method" was created with Perry M. Kent serving as chairman. Both users and vendors of WIM technology use this standard and prior to the revamping efforts commented that it was highly complicated and thus difficult to use. Therefore, the task group in charge of revamping E1318 was charged with the task of simplifying this standard. Dr. Clyde E. Lee of the University of Texas at Austin was the initial author of the standard and thus was recruited by task group chairman Perry M. Kent to be the author of the revamp. Dr. Lee agreed and thus after numerous revisions resulting from many comments from WIM system vendors and users as well as E17.52 subcommittee members, the

revamped edition of E1318 was published in the 2000 edition of Vol. 4.03 of the Annual Book of ASTM Standards. Furthermore, in 2001 several more revisions were made.

Test Methods

In 1997 a task group to develop a standard for testing vehicle detection devices was created and was chaired by John Hamrick. The task group began development of this standard by using the general testing method proposed during the development of the National Vehicle Detector Test Center concept discussed in the "Background on the VDC Project" section of this report. However, as the task group focused on the practical uses of this standard, a new approach was taken. Specifically, using the E1318 WIM standard model the "Standard Specification and Test Method for Highway Traffic Monitoring Devices" was created. The Test Methods task group recruited Dr. Lawrence A. Klein to accomplish the complex task of writing this standard.

In February of 2002 the "Standard Specification and Test Methods for Highway Traffic Monitoring Devices" was balloted. The results of the balloting process will be discussed during the June 2002 meeting in Salt Lake City, Utah.

Other Task Groups

Other task groups currently working on developing standards for traffic monitoring devices include:

- Piezo Sensor (Perry M. Kent, Chairman) – This task group was formed to develop a standard practice for using and installing piezoelectric sensors.
- Axle Adjustment Factors (Perry M. Kent, Chairman) – This task group was formed to develop a standard practice for estimating vehicle counts from single axle counts.
- Loop Sensor (Ryan Gidluck, Chairman) – This task group was formed to develop a standard practice for the design and installation of inductive loop sensors used for traffic monitoring data collection.

VDC Vision

During its six years of continued operation, the National Vehicle Detector Clearinghouse (VDC) has accumulated large amounts of valuable information on vehicle detection equipment for traffic monitoring and surveillance applications, as well as information on the users and providers of these types of technologies. The challenge for the future, however, lies in getting the information out to the people that can apply it in the field. Therefore, while still focusing on the collection of new and updated information on vehicle detection equipment, innovative ways of information dissemination to the people that it was meant for must be developed. Therefore, the vision for the future of the VDC concentrates on improving the current information dissemination methods, like the VDC web page, as well as developing new methods. This chapter describes the vision for the future of the VDC and with the exception of the items described in the VDC Web Page section, includes several activities that cannot be carried out due to the current level of funding.

VDC Web Page

Information dissemination via the Internet has many advantages, however, one disadvantage is that the personal connection is somewhat lost. Therefore, part of the vision for the VDC web page is to personalize it by adding pictures of the people using, developing, marketing, etc. vehicle detection equipment. Other ideas that will be further developed include a new VDC web page section that would showcase the numerous technical assistance requests that the VDC has responded to since its establishment. In addition, as previously mentioned, a new database that will include responses to the degree of satisfaction of State department of transportation personnel with specific vehicle detection equipment will be added to create a feeling of camaraderie among users of this type of equipment as well as providing a forum for exchanging information on troubleshooting and problem resolution.

In addition, a new section called the "Vendors Corner" may be added where specific vehicle detection equipment will be showcased on a monthly basis and may include new equipment as well as old favorites. The "Vendors Corner" idea is that it be facilitated by one of the VDC consultants and the format will mimic a typical conversation between a potential user (VDC consultant) and the vendor. For example, the VDC consultant may start the conversation by stating the following "I heard you have a new system for classification, what is it and how does it work? The vendor would then respond appropriately. Ideas to develop a cartoon characters to portray the VDC consultant and give the character a name (e.g. Traffic Tom) to further personalize the "Vendors Corner" will be investigated.

Standards Development

As mentioned previously, VDC team members have made great contributions to the standards development process for using and testing vehicle detection equipment by participating in the "Traffic Monitoring Devices" subcommittee, E17.52 of the American Society for Testing and Materials (ASTM). However, the State department of transportation personnel in charge of traffic monitoring and surveillance seldom utilize the standards developed by the E17.52 ASTM subcommittee. Most of the time State department of transportation *field* personnel in charge of traffic monitoring are unaware that these standards exist. Furthermore, those field personnel that are aware that these standards exist view them as a tedious and unimportant chore.

VDC team members realize that there is a lack of communication between standards developers and would-be users of the developed standards. Therefore, to help remedy this miscommunication, VDC involvement in the dissemination of these standards to the users is part of the VDC vision. The dissemination of the standards developed for the use and testing of vehicle detection equipment needs to include training on how to use these standards, as well as training on the benefits for the user, the specific State department of transportation department and the national transportation program. The VDC would be involved in coordinating and facilitating workshops during regularly scheduled events where State department of transportation field personnel are in attendance, such as the local technical assistance program (LTAP) annual conference and others.

In addition, to insure that the standards developed for traffic monitoring devices are user friendly and practical, a proposed function of the VDC would be to test these standards in cooperation with interested State department of transportation personnel. The testing of these standards would also provide much needed data to develop the precision and bias that is a requirement for many testing standards.

References

Mimbela, L. Y. and Klein, L. A., Summary of Vehicle Detection and Surveillance Technologies Used in Intelligent Transportation Systems (ITS), Vehicle Detector Clearinghouse (VDC), October 2001.

Southwest Technology Development Institute (SWTDI) at New Mexico State University (NMSU), Proposal for a National Test Center for Traffic Monitoring Devices, November 1992.

American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Section Four, Construction, Vol. 4.03, Road and Paving Materials; Vehicle Pavement Systems, ASTM, 100 Bar Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, 2000.